ACCESS 2008
Week 5 Group Assignment

Part I: Making fractals:

(1) Reconstruct a fractal: For one of the interesting fractals in the class notes or on our web page, reconstruct the affine maps from the mapping L-picture. Check your work with the TESTMAP procedure, and when you get the template right regenerate your fractal. (Depending on which fractal you choose, you may find that you need to do some fine-tuning of the parameter values to get the fractal as nice as you would like.) Add/change text in the .mws file as necessary, so that it corresponds to the fractal you generated. In the same file, insert a text/math explanation of how you used the L-diagram to reconstruct the parameter values of the affine transformations; explain this reconstruction in detail for just one of the transformations you used. You can display mathematics in text fields by first creating it as output of a Maple command, then copying and pasting the Maple output into the text field. I'll be happy to show you how to do this, if you ask me.

(2) Make an original fractal: perhaps you have a shape you want to create, or maybe you want to see what kind of fractal you get from an interesting template. Experiment! Make something that you would be proud to have in the on-line art gallery. If your group finds several fractals you really like please send them to us, but one will suffice. Don't forget to make sure all of your transformation functions are "contractions", i.e. that they scale all distances between pairs of points by a factor less than 1. I'm always surprised by some of the ACCESS creations.

Part II: Power laws and the Body Mass Index:

(3) Find the power law which best fits our ACCESS height-weight data. Import the ACCESS height-weight data from the appropriate link, and rework calculations by stealing and modifying commands from Erin's Thursday notes. You wish to create a document which derives and explains the power law you derive. At the end of this document create a **single** display which includes the following items (perhaps using different colors and a key to explain which curves are which):

(a) our class height-weight data points

(b) the graph of the power law function you found

(c) the graph of the power law function which was obtained from the national data, in the bmi.mws file linked to our home page.

(d) the curve of points for which BMI = 18.5 (the current lower recommended bound for adults).

(e) the curve of points for which BMI = 24.9 (the upper recommended bound for adults).

Using this display, discuss how well the BMI seems to fit with our data and the national data, compared to the two other power laws. Focus separately on children and adults in this discussion.

(4) Research BMI, and write a short (e.g. 4-6 page) report on what you find. I know from past years that there is some great original source material hidden in Marriott Library, but in order to find it you might want to first do an internet search to find the historical name attached to the BMI index. Some interesting questions to answer in the text of your report are:

(a) What is the B.M.I. and how is it applied?

(b) When was BMI originally invented, and by who? Was a different power suggested in case one wished a power law which included children as well as adults? (Hint: the answer to this question is yes, but not even Wikipedia knows it yet.)

(c) How do BMI tables and guidelines get modifed for children?

(d) Some on-line references explain the different BMI ranges for children as being (mainly) because body fat and muscle composition changes as people grow up. Such references also sometimes explain the fact that very tall people (like basketball players) have high BMI's because of all their muscles. For example, NBA 2008 MVP, skinny Kobe Bryant is 6-6 and typically weighs 220 pounds (although he sometime drops his weight to 200 pounds). This gives him a BMI between 23.1 and 25.4, on the edge of "overweight". Ex Utah Jazz player Karl Malone's height of 6-9 and weight of 256 lbs yields a BMI of 27.4, i.e. "overweight." Even very skinny Andrei Kirilenko's height of 6-9 and weight of 225 lbs yields a BMI of 24.1, near the upper recommended range. You guys might not remember her, but Mary Lou Retton was a famous short, muscular gymnast, with height 4-9 and weight 92 pounds, for a BMI of 19.9 - almost underweight? If you google her 1984 Olympic performance on YouTube, you'll see that she looks pretty healthy - not underweight. My (Nick's) thesis is that one of the main reasons why you have to change BMI ranges depending children's ages, is that different ages correspond to different average heights, and BMI is based on the wrong power law for weight as a function of height. If you used the correct power in your scaling law, I claim you could have a universal BMI for everyone, at least after their baby fat goes away at age 5 or so. Scientifically attack or defend my thesis, based on your mathematical work (in particular (3e)), further calculations, or on whatever reasoning and resources you can find. Remember Jon Seger's advice - it is your scientific job to question conventional wisdom and to support your own conclusions.

Due date and what you should email us:

Nick (korevaar@math.utah.edu) and Erin (erin@math.utah.edu) should receive your work on Thursday July 17, before midnight. Each group should send a single email, with attachments for parts (1)-(4) above. For parts (1), (2) send ".mws" attachments **with the output removed** - we will regenerate all your fractal files from your commands, by executing your worksheets. (We will first load the procedures in "Lpictures.mws."). Make sure this process will work with your files, before you send them! For part (3) you may leave your output in the file, since if you've added a legend to any of your displays this won't regenerate after you delete outpu. For part (4) use Microsoft Word. Have fun!

Nick will be around next week, and available for help.